Roll No.									

Dr. Shakuntala Misra National Rehabilitation University, Lucknow
Institute of Engineering and Technology
Department of Applied Science and Humanities
1st Sessional Examination- (2023-24)

Course Name: B.Tech. **Semester: 1st**
Subject Name: Engineering Mathematics-I **Paper Code: TBS 102**
Time – 1.5 Hrs + 15 minutes per hour extra time for V.I. & examinees with writer.
Max Marks-20

Instructions:

- The question paper consists of three sections namely A, B, and C. All sectio are compulsory.
- Section A- Each question will carries **01** mark. All questions are compulsor
- Section B- Answer any **5 out of 6** in the given questions with maximum **fi (50) words**. Each question will carries **2 marks**.
- Section C- Answer any **1 out of 2**in the given questions in maxim **onehundred fifty (150) words**. Each question will carries **5 marks.**

Section – A
Objective Questions

1. Answer all the following questions **5×1=05**

(i) The A matrix A is said to be nilpotent if

a) $A^2 = 0$ b) $A^2 = I$
c) $A^2 = A$ d) $A^2 = O$

(ii) A rank of matrix A is m and rank of matrix B is n then rank of matrix AB

a) $rank(AB) = mn$ b) $rank(AB) \geq rank(A)$
c) $rank(AB) \leq rank(B)$ d) $rank(AB) \leq \min\{rank(A), rank(B)\}$

(iii) A square matrix A is called orthogonal matrix if (A' is called Transpose of matrix A

a) $A' = A$ b) $A' = -A$
c) $AA' = I$ d) $AA' \neq I$

(iv) $\lim_{x-0} \frac{sinx}{x}$:

a) 0 b) -1
c) 1 d) None of These

(v) Find $\frac{d^3y}{dx^3}$, when $y = 4x^3 + 4x + 2$

a) 24 b) $24x$
c) 0 d) None of These

Section – B

Short Answer Type Questions

2. Answer any five of the following questions in maximum 50 words. 5×2=10

(i) Find the nth differential co-efficient of $cos(ax + b)$.

(ii) State the Rolle's theorem and also write the Physical Significance..

(iii) Investigate, for what value of λ and μ do the system of the equations have no solution $x + y + z = 6,\ x + 2y + 3z = 10,\ x + 2y + \lambda z = \mu$.

(iv) Expand e^x in power of x by Maclaurin's theorem.

(v) Difference between singular and non-singular matrix.

(vi) Find the rank of matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.

Section – C

(Descriptive Questions)

3. Answer *any one* question in maximum 150 words. 1×5=05

(i) If $y = e^{\cos^{-1}x}$, show that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$.

(ii) Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence, compute A^{-1}. Also find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$.